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Introduction The fatty acid (FA) composition of ruminant meat is influenced by many aspects of the production system including the animal finishing diet. Beef produced from grass-fed animals contains greater concentrations of the beneficial long-chain (LC) n-3 polyunsaturated fatty acids (PUFA) than beef produced from concentrate-fed animals (French *et al*, 2000). Since the animal diet is likely to vary over the farming year (McAfee *et al*, 2009), it is possible that the season of animal slaughter will also influence quantities of LCn-3 PUFA found in meat and subsequently available for human consumption. The aim of this study was to determine the FA composition of beef produced in Northern Ireland, examining the effects of both season of slaughter and reported finishing diet.

Methods Samples of beef longissimus dorsi (LD) muscle (n= 234) were collected fortnightly from a commercial abattoir over a 12 month period. Producers were identified and contacted to obtain information on whether the finishing diet provided in the month prior to slaughter was grass, concentrates, grass supplemented with concentrates or silage supplemented with concentrates. Total lipid was extracted from lean tissue according to the Folch method (Folch *et al*, 1957) and FA methyl esters were analysed using gas chromatography. Principle components analysis (PCA) was performed on the proportional FA data (% w/w) to investigate the influence of season and reported finishing system on FA profiles. To analyse for the effect of season and diet, a factorial ANOVA (SPSS v. 11.5) was used including season and diet as well as their interaction as fixed effects. Bonferroni post hoc test was used to adjust for multiple comparisons. Seasons defined as Spring: March – May; Summer: June-August; Autumn: September – November; Winter: December – February.

Results The intramuscular fat content of the LD muscle was not significantly affected by season. Beef cattle finished in autumn had significantly higher concentrations of alpha-linolenic acid (C18:3n-3), eicosapentaenoic acid (C20:5n-3), docosapentaenoic acid (C22:5n-3) and total conjugated linoleic acid (CLA) ($P<0.01$) than cattle finished in other seasons. There were significant interactions between season and diet for C22:5n-3 ($P<0.01$), LCn-3 PUFA ($P<0.01$) and total n-3 PUFA ($P<0.05$) in beef samples from animals reportedly finished on grass in autumn. This interaction showed that in autumn animals that were reportedly finished on grass had higher proportions of these FA compared to those finished on concentrates alone or concentrates plus forage.
Two components in the PCA analysis explained 75% of total FA variation (PC1 55%, PC2 20%). The PCA scores plot (Fig 1) showed that samples of LD muscle from beef produced in autumn (□) were grouped mainly in the lower left quadrant. The loadings plot showed that autumn produced beef was associated with higher levels of stearic acid C18:0), linoleic acid (C18:2n-6), C18:3n-3, arachidonic acid (C20:4n-6), C20:5n-3 and C22:5n-3. There is no clear separation between the other seasons on the PCA scores plot (Figure 1).

Conclusions Results of this study provide evidence that there is seasonal variation in the concentration of a number of FA in beef produced under a range of commercial production systems. The higher concentrations of LCn-3 PUFA and total CLA in autumn-produced beef may have potential benefits for consumer health. Further research is needed however, to determine the time course of these changes in order to optimise conversion of the C18:3n-3 from grass to LCn-3 PUFA in the beef muscle.

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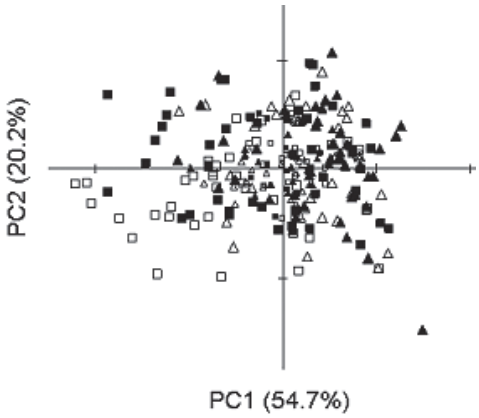

Figure 1 PCA scores plot for FA analysis. Δ Spring; ▲ Summer; □ Autumn; ■ Winter

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